

ABSTRACT

Evaluation of mechanical properties of conventional and esthetic aligning arch wires – A comparative invitro study.

Introduction:

Growing demand of invisible braces by esthetically conscious patients has led to remarkable inventions in materials for esthetic labial archwires. Archwires with excellent optical clarity and mechanical properties comparable to conventional archwires have been manufactured by almost all the leading companies of orthodontic products in the past two decades, but their clinical use is still limited. The goal of this research was the charecterisation of mechanical properties of three aligning archwires of different materials (NITI, FRPC,EPOXY COATED NITI)

Materials and Methods:

Force decay was evaluated by comparing results of 3-point bending tests of nickel-titanium (NiTi), fiber-reinforced polymer composite (FRPC), and Epoxy coated NITI archwires. As utilizing the universal testing machine for a single wire around 28 days is impractical, the following protocol was used: wire segments were placed in a custom-made jig designed to deflect each segment either 1 or 2 mm for 28 days. Each segment was once again tested in 3-point bending to examine consistency of the bending profile. Paired t-tests were used to statistically compare pre- and post- deflection forces. A control group consisting of wires not subject to the 28 days constant deflection was tested to ensure that the initial testing did not alter the second 3-point bend test.

The surface charecteristics of the wires before and after deflection had been studied with SEM & optical microscope.

Results:

1. The force and variation in deflection varied from 1 to 2mm activation and these were statistically significant at all time points for the three groups of wires
2. For 1 mm deflection, there was no statistical difference in the variation in deflection for the three groups of wires at the various time points tested.
3. At 2mm deflection, for conventional Niti, the force values from day 1 to day 28 decreased, however these were statistically not significant, while significant changes were observed in the other 2 groups
4. Observation of tested NiTi wire under SEM analysis and optical microscope revealed smoother striations as seen in predeflection with minimal surface changes both in 1mm & 2mm deflection. Whereas epoxy coated and FRPC showed characteristic surface changes after testing, particularly 2mm deflection, where the esthetic arch wires were unable to withstand the deflection.

Conclusions:

Though all three types of wires performed equally at 1mm deflection, conventional NiTi performed better as the deflection increased. This invitro finding has to be confirmed with a clinical trial.